Prioritized Technology: Small Satellites – Non-Toxic Chemical Propulsion

Technical Goal

(3) Chemical thrusters:
- Thrust levels 0.2 to 1.0 N to provide rapid orbit insertions
- >200 s Isp to keep propellant volume small
- Secondary payload safe
- Pulse mode and impulse-bit control to meet station keeping and pointing requirements (similar to hydrazine performance)
- Low temp (< 0C) storage to reduce system power requirements.

- Biprop reliability, including pumps

Mission Applications

Rapid orbit insertions can be accomplished in hours vs months; allows missions to be completed in days vs months, which reduces s/c reliability requirements.

More likely to ride as a secondary payload than hydrazine (e.g. universities will be more trusted with non-toxic propellants), and lower cost ground ops

Technical Status

(3) Multiple systems are under development; *Miniaturization is the gap; thermal management is key*
- ESPA-class SOA: hydrazine; Isp ~220 s
- CubeSat SOA: Cold gas thrusters (e.g on MarCo) have Isp ~70 s; requires large volume of gas for delta-Vs larger than a few 10's m/s.
- 0.2 to 1.0 N, ~220 s Isp thrusters being developed for CubeSats under SBIR
- 1 N thrusters on GPIM tech demo: system level issues will be demonstrated on a larger system (>ESPA-class) Catalyst and chamber materials/coatings are under development to achieve cycles/life.
- Water-based (1 N, 300 s Isp) tested in vacuum, approaching ready for flight test. Burst-mode operation; electrolysis requires high power. (TBR)

Development Cost and Schedule

Stability requirements, magnetic environment, propellant species all should be considered for particular missions